Space Weather Technical Forecast

Issued on Thursday, 29 August 2024 at 13:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with a peak C7.0 flare at 28/0408 UTC from just over the southeast limb. There are nine regions currently on the disc, with AR3806 the most likely flare source, having recently rotated onto the southeast disc. This moderately sized but compact region has some apparent complexity, with the potential for a delta spot, however it currently remains too close to the southeast limb to accurately assess. The other regions on the disc remain relatively simple, with no significant growth observed.

A couple of weak filament eruption were observed from the northwest disc, just before 29/0100 UTC and around 21/0610 UTC, however imagery has been inconclusive for any Earth-directed CME. No other Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by ACE at L1, continued to show ongoing influence from a CME that arrived early on 27 Aug. Solar winds remains speeds persisted at background, varying between 280-330 km/s. The density was average or below. The Interplanetary Magnetic Field, Bt, was strong, mainly between 15-18nT. The north-south component, Bz exhibited a gradual but turbulent rotation from moderately negative (southward) to be strongly positive (northward), from -10nT to +16nT. Phi angle was negative for much of the period (towards the Sun). Geomagnetic activity has been Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed at GOES16 was at background. The 24-hour fluence was below the Active threshold, with 9.07e5 integrated pfu observed at 29/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast with M-class flares likely and a slight chance of isolated X-flares.

Solar Wind /Geomagnetic Activity: There are no Earth-directed CMEs. Current CME enhancement is forecast to soon wane, however any fast wind from coronal hole 62/+ may give a slight enhancement to the solar wind on days 1 and 2 (29-30 Aug), although confidence is low. Geomagnetic activity is expected to be mainly Quiet throughout with isolated Unsettled intervals. There is a chance of Active intervals, with a slight chance G1 Minor Storms, from any fast wind enhancement day 1-2 (29-30 Aug) and again late day 4 (01 Sep).

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background, but with a slight chance of reaching the S1 Minor Radiation Storm level, should any larger flares occur, especially from the western disc. High energy electron flux is expected to remain at background. The associated 24-hour fluence is expected to persist below Active.

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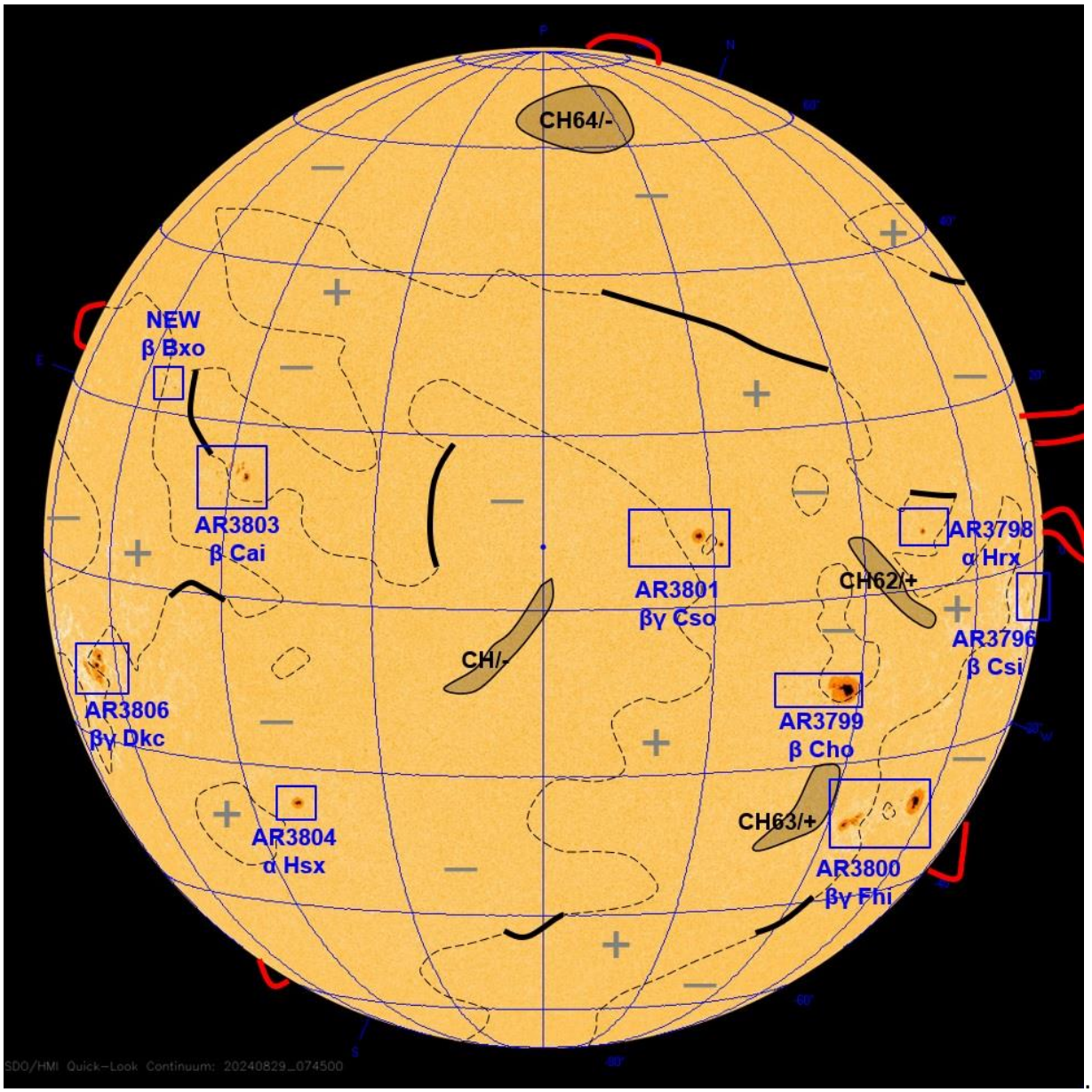
Figure 1. Solar Analysis Valid 29/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The CME that was seen leaving the Sun on 23 Aug arrived at L1 early on 27 Aug. Earth still lies within the magnetic cloud from this feature, with enhanced solar wind parameters that are expected to ease over the coming 12 hours. There are no other Earth-directed CMEs.

The fast wind from coronal hole 62/+ has the potential to give an enhancement to the solar wind later day 1 and 2 (29-30 Aug), perhaps reaching slightly elevated levels. However this coronal hole was not clearly present in imagery on the previous rotation, with the solar wind parameters contaminated by previous CME impacts. The western disc coronal hole, currently unnumbered, is now signaled to bring associated fast wind enhancements on 02 Sep, just beyond this period.

Geomagnetic activity is expected to be mainly Quiet throughout with isolated Unsettled intervals. There is a chance of Active intervals, with a slight chance G1 Minor Storms, from any fast wind enhancement day 1-2 (29-30 Aug) and again late day 4 (01 Sep).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: Enlil Forecast

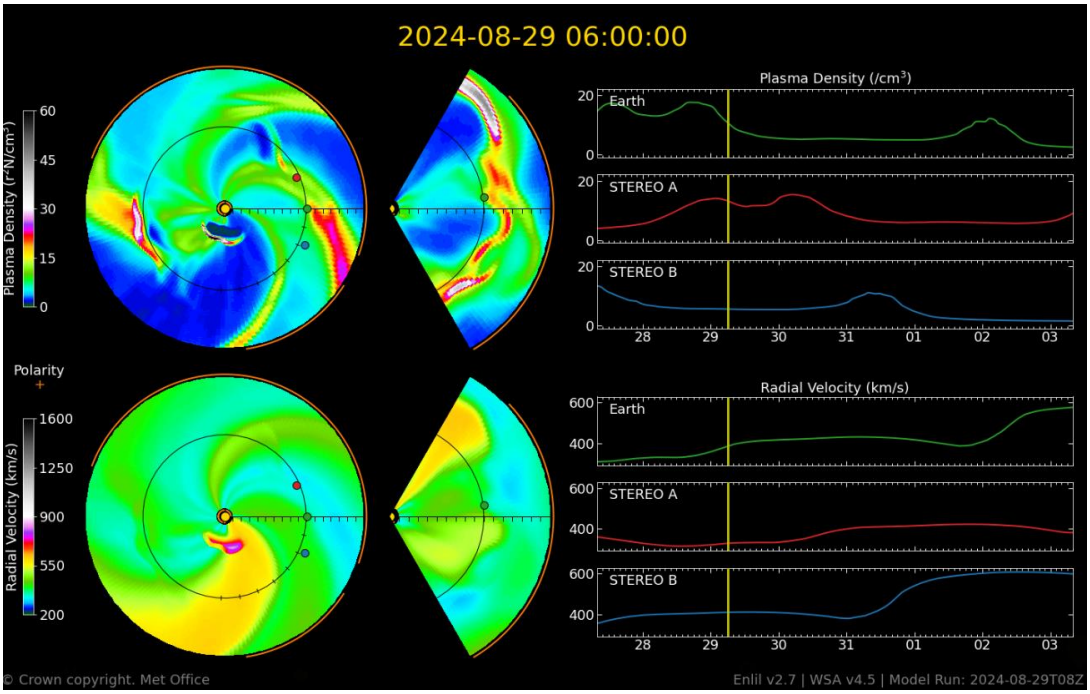

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Figure 2b: L1 Solar winds, showing prolonged CME influence

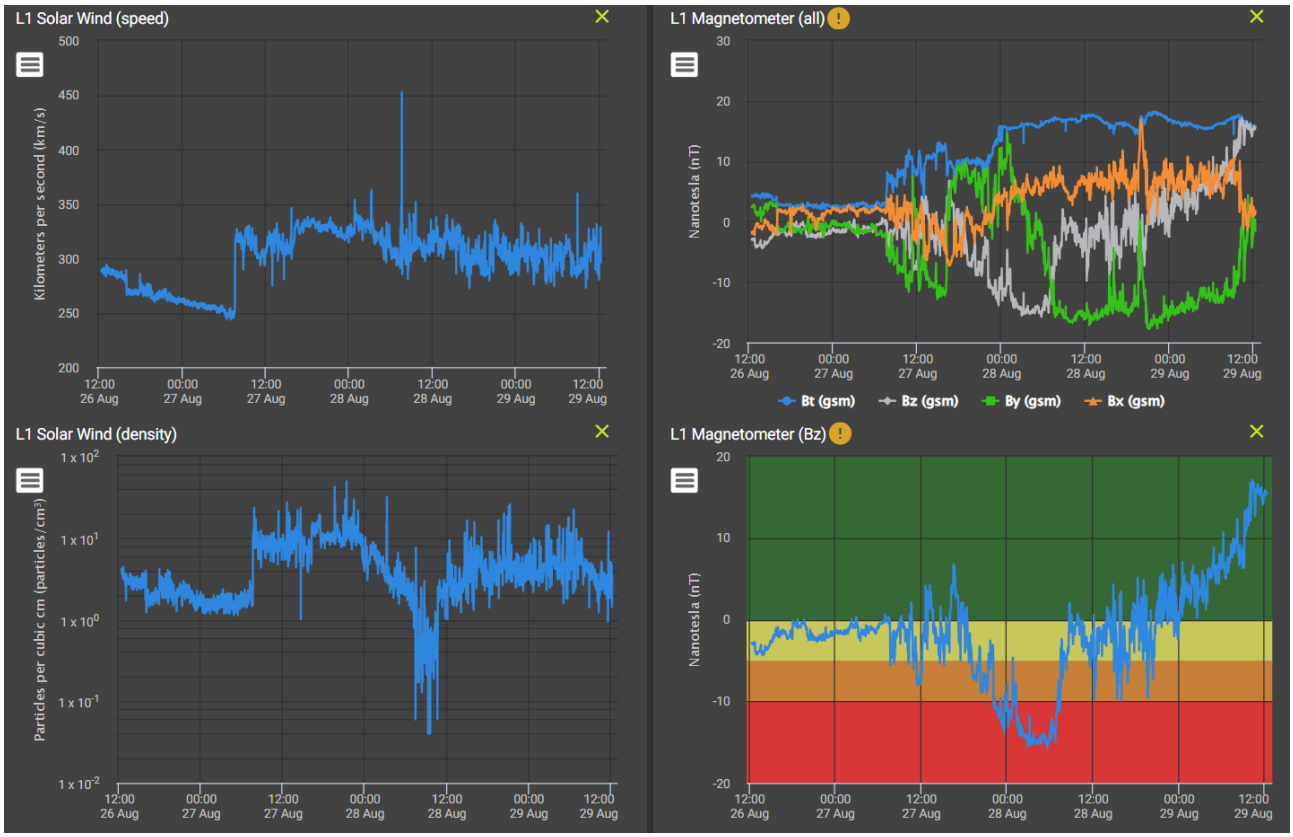
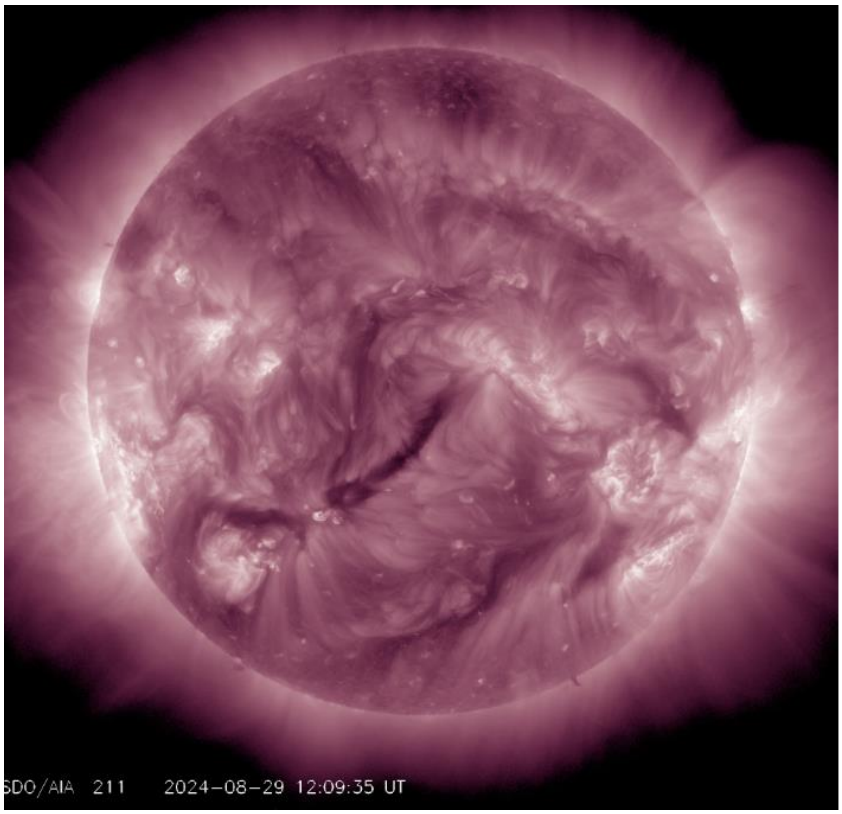


Figure 2c: SDO aia-211, with only weak coronal holes evident.



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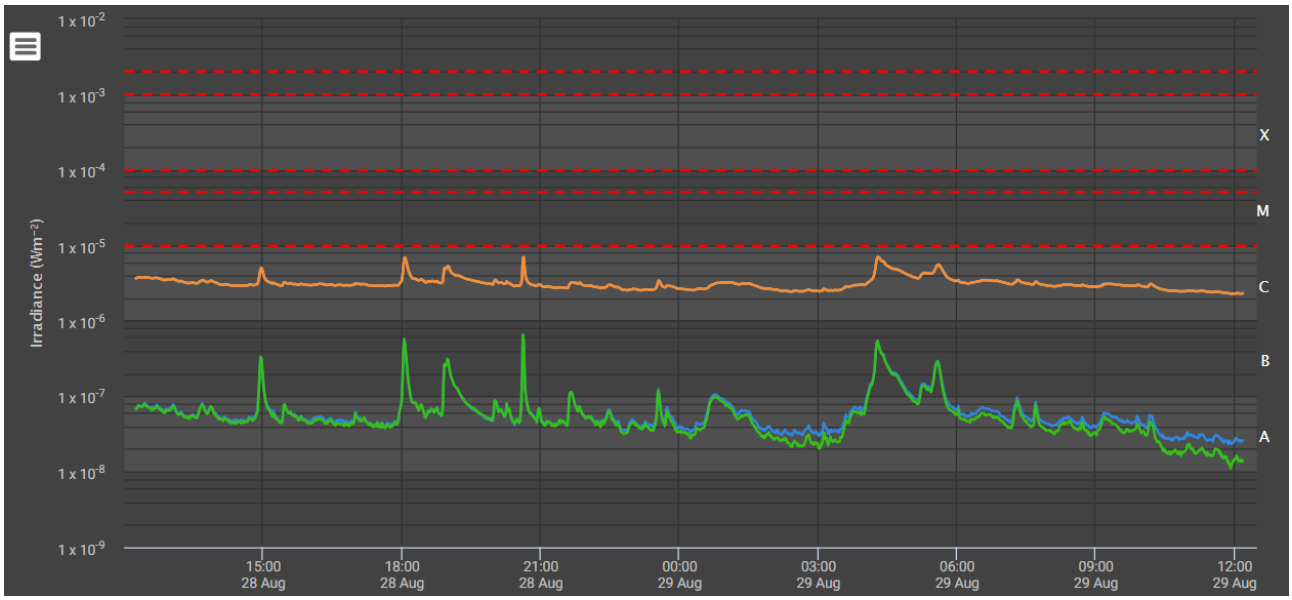
Radio Blackouts - X-Ray Flares:

Flare activity is expected to be Low to Moderate, with M-class flares considered likely and a slight chance of isolated X-class flares. The main flare risk is likely AR3806 on the southeast disc, as this appears to be a relatively small but compact sunspot group with more details becoming apparent as this rotates into a clearer view. The other regions on the disc are generally smaller and simpler, with perhaps the exceptions of AR3800 in the southwest and AR3801 just west of centre disc. These both have small mixed polarity regions, resulting in a slightly more complex beta-gamma classification.

There are a number of regions due to rotate off the disc during this period, most of which are not contributing significantly to the flare risk. Of these, AR3800 rotates off during day 4 (01 Sep) and is the highest flare risk of the five regions, but the overall flare risk will not drop until after the end of this period, when it is properly over the limb. In the meantime, ex-AR3780 is due to rotate back onto the disc later in this period which may balance out any losses over the west limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: GOES-16/18 X-ray Flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background levels and is likely to persist at this level. There are a number of moderately sized sunspot regions in the western hemisphere which is a more favourable position to give proton enhancements at L1, should any significant flares occur. However, these regions currently lack magnetic complexity. Consequently, there is currently a slight chance of exceeding the S1/Minor Radiation Storm threshold through this period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background. No significant wind speed increases are anticipated, in the period with any coronal hole sourced enhancements expected to be weak. However, the recent coronal mass ejection arrival may have resulted in an increase in electron counts at lower orbits, which have the potential to relax toward GEO. Background flux is most likely to continue but with a chance of periods of Moderate at diurnal max.

Fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period, with MOSWOC REFM currently giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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